(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 July 2001 (12.07.2001)

PCT

(10) International Publication Number
WO 01/50765 A1

(51) International Patent Classification[7]: H04N 7/24, 7/173

(21) International Application Number: PCT/IB00/01852

(22) International Filing Date:
12 December 2000 (12.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/474,595 29 December 1999 (29.12.1999) US

(71) Applicant: GATEWAY, INC. [US/US]; 610 Gateway Drive, North Sioux City, SD 57049 (US).

(72) Inventor: LIEBENOW, Frank, W.; 233 Bison Trail, Dakota Dunes, SD 57049 (US).

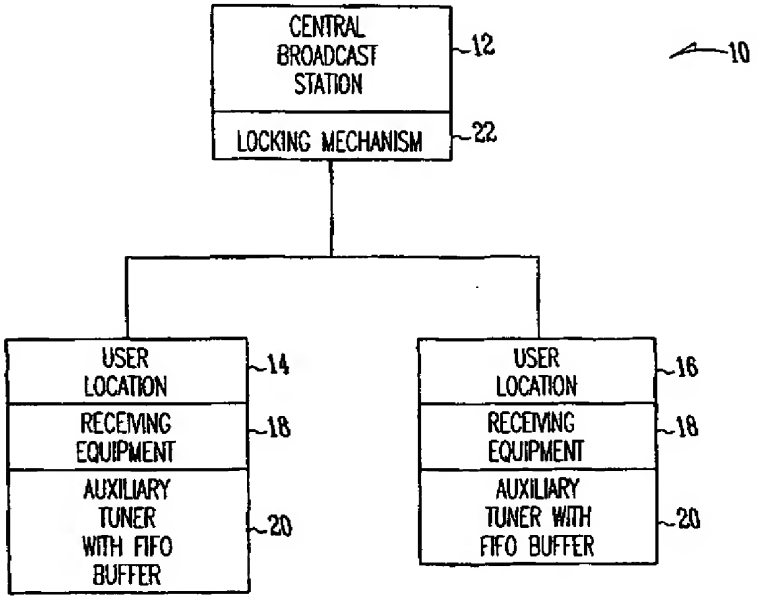
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF INCREASING CAPABILITIES OF STREAMING CONTENT INCLUDING VIDEO ON DEMAND



(57) Abstract: A system and method for increasing capabilities of streaming content including video on demand to multiple users are provided. The system includes a central broadcast station and at least two user locations for receiving streaming content from the central broadcast station. Each user location includes receiving equipment capable of tuning into more than one channel simultaneously and capable of capturing content from a first channel in a first in first out buffer as it presents content from a second channel.

WO 01/50765 A1

METHOD OF INCREASING CAPABILITIES OF STREAMING CONTENT INCLUDING VIDEO ON DEMAND

Field

The present invention relates generally to data processing systems and more particularly to a system and method for increasing the capabilities of streaming content.

Background

With the advent of increased access to computers, home entertainment systems, and networks such as the Internet and the World Wide Web (WWW), it has become increasingly common for a wide variety of providers to present to multiple users content on demand. Such content includes but is not limited to streaming video, audio and/or data. Such content is also increasingly common to shared receiving systems serving multiple living units such as hotels and the like. Video on Demand (VOD) is a streaming content service enabling a user to obtain video information immediately in real time through a request terminal. This is contrasted with pay per view, where the user must abide by the schedule of a program provider.

In a typical streaming application such as video on demand, each user has the opportunity to view any particular content starting at random times. Each user gets a complete download of the content they have selected. Each user receives streaming content on a channel which is typically dedicated solely to the content the particular user is viewing. In systems with many potential viewers, many channels and a large amount of bandwidth are required. As the amount of required bandwidth increases, costs associated with providing the bandwidth increase as well. Practical limits on bandwidth result in a limited amount of bandwidth availability for multiple channels.

When bandwidth is limited, especially in broadcast media, the number of users able to share the bandwidth is limited to the number of unique channels allocated to the system. Even if multiple users want to access the same content, a unique download is required since there is little probability that two users will start the same content at the same time.

Summary

The present invention overcomes problems of the prior art by providing in various embodiments a system and method of increasing capabilities of streaming content including video on demand.

A system and method for increasing capabilities of streaming content including video on demand to multiple users includes in one embodiment a central broadcast station and at least two user locations for receiving streaming content from the central broadcast station. Each user location comprises receiving equipment capable of tuning to more than one channel simultaneously and capable of capturing content from a first channel as it presents content from a second channel.

A method embodiment for providing streaming content while conserving bandwidth includes receiving a program at a first user station on a first channel, and receiving a first portion of the program at a second user station on a second channel while a second portion of the program is captured in a FIFO buffer. The second portion of the program is presented to the second channel from the FIFO buffer after the first portion of the program is completed. The second channel is freed for other use after transmitting begins.

Other embodiments are described and claimed.

Brief Description of the Drawings

Figure 1 is a block diagram showing the major components of an embodiment of the present invention;

Figure 2 is a block diagram of an embodiment of the present invention;

Figure 3 is a block diagram of an embodiment of the present invention;

Figure 4 is a flow chart diagram of one embodiment of the present invention;

Figure 5 is a flow chart diagram of yet another embodiment of the present invention;

Figure 6 is a flow chart diagram of still another embodiment of the present invention;

Figure 7 is a flow chart diagram of another embodiment of the present invention; and

Figure 8 is a diagram of a computer on which embodiments of the invention may be employed .

Description of Embodiments

In the following detailed description of sample embodiments, reference is made to the accompanying drawings which form a part hereof, and which are shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and logical, structural, electrical, and other changes may be made without departing from the scope of the present invention.

In one embodiment, the present invention is a system 10 for providing streaming content such as video on demand to multiple users. Referring to Figure 1, the system 10 comprises a central broadcast station 12 and at least two user locations 14, 16, for receiving streaming content from the central broadcast station. Each user location comprises receiving equipment 18 capable of tuning into more than one channel simultaneously and capable of capturing content from at least one content channel as it presents content from a channel other than the channel or channels from which it is capturing content. In one embodiment, each user location comprises an auxiliary tuner having a first in first out (FIFO) buffer 20 for capturing content from one of the channels.

In a further embodiment, the at least two user locations comprise a first user location and a second user location. The first user location is capable of receiving a program on a first channel. The second user location is capable of receiving a receiving a first portion of the program on a second channel while a second portion of the program is downloaded to the FIFO buffer of the second user location. The FIFO buffer is capable of transmitting the second buffered portion of the program to the user after the first portion of the program is completed, such that the second channel is freed for use after the transmitting begins.

In one embodiment, the system 10 further comprises a locking mechanism capable of ensuring that the second portion of the program is completely downloaded from the first channel to the FIFO buffer of the second user location even if the first user station stops receiving the program before it ends. In a further embodiment, the system comprises a third user station capable of receiving a third portion of the program on a third channel while a fourth portion of the program is downloaded to a FIFO buffer of the third user station. The FIFO buffer is capable transmitting the fourth portion of the program from the FIFO buffer after the third portion of the program is completed, such that the third channel is freed for use after the transmitting begins. This system in one embodiment comprises a locking mechanism capable of ensuring that the fourth portion of the program is completely downloaded from the first channel to the FIFO buffer of the third user location even if the first user station stops receiving the program before it ends.

It should be understood that the number of user locations can be increased without departing from the scope of the invention.

In another embodiment, each user location is capable of sending a request for streaming content to the central broadcast station, and the central broadcast station is capable of broadcasting requested streaming content to a first user location and a first channel and a second user location and a second user channel at different times. For example, at time T1 in response to a first request for streaming content from a first user location, the central broadcast station is capable of recognizing a second request by a second user for the same streaming content and begins to broadcast the content on a second channel at time T2. The central broadcast station is further capable of communicating to the auxiliary tuner at the second user location to capture content from the first channel in the FIFO buffer, such that the second user views a first portion of the requested content corresponding in length from time T1 to time T2 on a second channel while the auxiliary tuner captures a second portion of the content from the first channel starting at T2 to the end of the program in the FIFO buffer, such that the second user views the second portion of the content from the FIFO buffer after viewing the first portion of the content from the second channel. In this

embodiment, the second channel is freed for use when the program shown on the second channel reaches requested content stored or captured in the FIFO buffer, thereby increasing available system bandwidth for use.

In a further embodiment, the system further comprises a locking mechanism 22 to ensure that the entire content of the program is downloaded from the first channel to the FIFO buffer of the auxiliary tuner of the second user location.

In one embodiment, the central broadcast station is capable of recognizing a third request by a third user for the same streaming content and begins to broadcast the content on a second channel at time T3. The central broadcast station is further capable of communicating to the auxiliary tuner at the third user location to capture content from the first channel in the FIFO buffer, such that the second user views a third portion of the requested content corresponding in length from T1 to T3 on a third channel while the auxiliary tuner captures a fourth portion of the content from the first channel starting at T3 to the end of the program in the FIFO buffer, and such that the third user views the fourth portion of the content from the FIFO buffer after viewing the third portion of the content from the third channel. In this embodiment, the third channel is free for use, thereby increasing available system bandwidth. The system and method of the present invention contemplates operation with a large number of users, such as would be served in multi-unit housing or a hotel.

Operation of the system is described referring to Figure 2. Using the example of video on demand, assume a video consists of sections or parts, *a*. The complete video would be the ordered set *{aO, a1, a2, . . . aN}*. Now assume that *user 1* 210 started watching this video at 1:00 on a first channel *Channel X* 212 and has already watched the subset of video sections *{a0, a1, a2, . . . , aK}*. Now *user 2* 214 starts watching the same video starting at *a0* on a second channel *Channel Y* 216 but at a later time, say 1:15. The *second user* 214 would watch sections *{a0, a1, a2, . . . , aK}* on *Channel Y* 216. Concurrently, video sections *{aK+1, aK+2, . . . , aN}* are being delivered to *user 1* 210 on first channel *Channel X* 212. *User 2* 214 has an auxiliary tuner 230 tuned to first channel *Channel X* 212 to capture video sections *{aK + 1, aK+2, . . ., aN}* in a FIFO

buffer while viewing video sections *{a0, a1, a2, . . . , aK}* on second channel *Channel Y* 216. Once section *aK* is viewed, *user 2* 214 starts viewing the remaining sections *{aK + 1, aK+2, . . ., aN}* from the FIFO buffer 230, freeing up second channel *Channel Y* 216 for another user. This reduces overall system bandwidth usage. In one embodiment a seamless program is assured by having *user 2* view video sections *{a0 , a1, a2, . . ., aK, aK+1}* on second channel *Channel Y* 216 and start viewing from the FIFO buffer 230 at section *aK+2*. A locking mechanism associated with the broadcast station and the auxiliary tuner is provided to assure the video is completely downloaded, even if *user 1* 210 decides to stop viewing the video.

One skilled in the art would see that by adding additional tuners and FIFO buffers the efficiency of the system would be increased.

In one embodiment, additional tuners and FIFO buffers are added to the system, resulting in a system and method having increased efficiency. Referring to Figure 3, User location 1 (310), User location 2 (312) and User location 3 (314) are shown. In use, user 1, user 2 and user 3 begin watching movie A at three different times, T1, T2 and T3, respectively. User 1 receives the entire movie on Channel 1 (316). Segment 1 (S_1) is the portion of movie A from T1 to T2. User 2 receives Segment 1 on Channel 2 (318). Concurrently User 2 receives Segment 2 on Channel 1 and time shifts Segment 2 using a first FIFO buffer located at user location 2. Channel 2 is only needed for the length of time to show Segment 1.

User location 3 has an auxiliary tuner with two FIFO buffers, $FIFO_X$ (320) and $FIFO_Y$ (322) . At T3, User 3 starts watching movie A. Channel 3 (324) now transmits the first part of Segment 1 (Segment 1a shown as S_{1a} at Figure 3) while the second part of Segment 1 (Segment 1b shown as S_{1b} at Figure 3) is copied from Channel 2 into $FIFO_X$. Then the second part of Segment 1, Segment 1b, is played from $FIFO_X$ to complete Segment 1. During this time, Segment 3 (Segment 3 shown as S_3 at Figure 3) is recorded to $FIFO_Y$. After Segment 1 is finished playing, Segment 4 (shown as S_4 at Figure 3) must be sent on Channel 3 since it had already gone by on Channel 1 when User 3 started watching movie A. After Segment 4 is played, Segment 3 (shown as S_3 at

Figure 3) is played from $FIFO_1$. In one embodiment, the method described may be a computer based method.

The present invention is directed in one embodiment to a method for providing streaming content including video on demand while conserving system bandwidth. The method comprises providing a system including a central broadcast station and at least two user locations connected to the central broadcast station. The user locations comprise receiving equipment capable of tuning into more than one channel simultaneously and an auxiliary tuner having a first in first out (FIFO) buffer capable of capturing content from a first channel as it presents content from a second channel. In one embodiment, the method is a computer based method.

As shown in Figure 4, the method embodiment 400 comprises sending a first request 402 for streaming content from a first user location to the central broadcast station. The requested streaming content is broadcast from the central broadcast station (CBS) to the first user location and a first channel at time T1 in response to the first request as shown at 404. A second request 406 is sent at a later time T2 from a second user location to the CBS for the same streaming content. At 408 the central broadcast station recognizes the second request and then broadcasts 410 starting at time T2 the first portion of the content corresponding in length from T1 to T2 on a second channel to the second user location. The CBS also communicates to the auxiliary tuner of the second user location to capture content from the first channel in the FIFO buffer starting at time T2, as shown at 412.

The auxiliary tuner captures the second portion of the content from the first channel in the FIFO buffer starting at time T2 until the end of the program, 414. The second user views the first portion of the requested content on a second channel while the auxiliary tuner captures the second portion of the content in the FIFO buffer, 416. The second user views the second portion of the content from the FIFO buffer after viewing the first portion of the content from the second channel 418, and the second channel is then freed for use thereby increasing available bandwidth 420.

Referring to Figure 5, in another embodiment, the method 300 further

comprises sending a third request 522 for the same streaming content from a third user location to the central broadcast station. The central broadcast station recognizes the third request 524 and then broadcasts 526 starting at time T3 the third portion of the content corresponding in length from T1 to T3 on a third channel to the third user location. The central broadcasting station also communicates 528 to the auxiliary tuner of the third user location to capture content from the first channel in the FIFO buffer starting at time T3. The auxiliary tuner captures the fourth portion of the content from the first channel in the FIFO buffer starting at time T3 until the end of the program 530. The third user views the third portion of the requested content on a third channel while the auxiliary tuner captures the fourth portion of the content in the FIFO buffer 532. The third user views the fourth portion of the content from the FIFO buffer after viewing the third portion of the content from the third channel 534, and the third channel is then freed for use thereby increasing available bandwidth 536.

Referring to Figure 6, a method embodiment 600 for providing streaming content while conserving bandwidth comprises receiving a program at a first user station on a first channel 602, receiving a first portion of the program at a second user station on a second channel 604 while a second portion of the program is captured in a FIFO buffer 606, transmitting the second portion of the program from the FIFO buffer after the first portion of the program is completed 608, and freeing the second channel for use after transmitting begins 610. In one embodiment a locking mechanism ensures that the second portion of the program is completely downloaded from the first channel to the FIFO buffer of the second user location if the first user station stops receiving the program before it ends.

In a further embodiment, shown at Figure 7, the method further comprises receiving a third portion of the program at a third user station on a third channel 702 while a fourth portion of the program is downloaded to a FIFO buffer 704, transmitting the fourth portion of the program from the FIFO buffer after the third portion of the program is completed 706 and freeing the third channel for use after transmitting begins 708. A locking mechanism ensures that the fourth portion of the program is completely downloaded to the FIFO buffer of the third user location if the first user station stops receiving the program before it ends.

The method of the present invention in one embodiment may comprise computer programs written to perform the methods on a personal computer 800 as shown in Figure 8. The computer programs run on the central processing unit 810 out of main memory, and may be transferred to the main memory from permanent storage via disk drive when stored on removable media or via a network connection or modem connection when stored outside of the personal computer, or via other types of computer or machine readable medium from which it can be read and utilized. The computer programs comprise multiple modules or objects to perform the method. The type of computer programming languages used to write the code may vary between procedural code-type languages to object oriented languages. The files or objects need not have a one to one correspondence to the modules or method steps described depending on the desires of the programmer. Further, the method and apparatus may comprise combinations of software, hardware and firmware as is well known to those skilled in the art.

In conclusion, the present invention provides in various embodiments a system for providing streaming content such as video on demand to multiple users, a receiving station capable of tuning into multiple channels and of buffering data in a FIFO buffer, and methods for broadcasting and receiving streaming content.

The system in one embodiment comprises a central broadcast station and at least two user locations connected to the central broadcast station. Each user location comprises receiving equipment capable of tuning into more than one channel simultaneously and capable of capturing content from at least one content channel as it presents content from a channel other than the channel(s) from which it is capturing content. In one embodiment, each user location comprises an auxiliary tuner having a first in first out (FIFO) buffer for capturing content from the first channel.

In another embodiment, the system comprises a first user location and a second user location. The first user location is capable of receiving a program on a first channel. The second user location is capable of receiving a receiving a first portion of the program on a second channel while a second portion of the

program is downloaded to the FIFO buffer of the second user location. The FIFO buffer is capable of transmitting the second portion of the program after the first portion of the program is completed, such that the second channel is freed for use after the transmitting begins. In another embodiment, the system further comprising a locking mechanism capable of ensuring that the second portion of the program is completely downloaded from the first channel to the FIFO buffer of the second user location even if the first user station stops receiving the program before it ends.

In another embodiment, the present invention comprises a method for receiving streaming content, including receiving the streaming content at a first user station on a first channel, receiving a first portion of the streaming content at a second user station on a second channel while a second portion of the streaming content is downloaded to a FIFO buffer, transmitting the second portion of the streaming content from the FIFO buffer after the first portion of the streaming content is completed, and freeing the second channel for use after transmitting begins.

In a still further embodiment, the present invention comprises a computer-readable medium having computer-executable instructions for performing the above described methods.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiments shown. This application is intended to cover any adaptations or variations of the invention. It is intended that this invention be limited only by the following claims, and the full scope of equivalents thereof.

WHAT IS CLAIMED IS:

1. A system for providing streaming content to multiple users, the system comprising:

a central broadcast station to broadcast streaming content;

at least two user locations to receive the streaming content, each of the said at least two user locations comprising receiving equipment capable of tuning into more than one content channel simultaneously and capable of capturing content from at least one content channel as it presents content from a channel other than the at least one channel from which it is capturing content.

2. The system of claim 1, wherein each user location further comprises an auxiliary tuner having a first in first out (FIFO) buffer for capturing content from the first channel.

3. The system of claim 2, wherein:

each of the said at least two user locations comprises a first user location and a second user location, the first user location capable of receiving a program on a first channel, and the second user location capable of receiving a receiving a first portion of the program on a second channel while a second portion of the program is downloaded to the FIFO buffer of the second user location; and

wherein the FIFO buffer is capable of transmitting the second portion of the program after the first portion of the program is completed, such that the second channel is freed for use after the transmitting begins.

4. The system of claim 3, further comprising a locking mechanism capable of ensuring that the second portion of the program is completely downloaded from the first channel to the FIFO buffer of the second user location even if the first user station stops receiving the program before it ends.

5. The system of claim 3, and further comprising:

a third user station capable of receiving a third portion of the program on a third channel while a fourth portion of the program is downloaded to a FIFO buffer of the third user station; and

wherein the FIFO buffer is capable of transmitting the fourth portion of the program from the FIFO buffer after the third portion of the program is completed, such that the third channel is freed for use after the transmitting begins.

6. The system of claim 5, further comprising a locking mechanism capable of ensuring that the fourth portion of the program is completely downloaded from the first channel to the FIFO buffer of the third user location even if the first user station stops receiving the program before it ends.

7. The system of claim 2, wherein:

each user location is capable of sending a request for streaming content to the central broadcast station;

the central broadcast station is capable of broadcasting requested streaming content to a first user location and a first channel at time T1 in response to a first request for streaming content from a first user location;

the central broadcast station is capable of recognizing a second request by a second user for the same streaming content and begins to broadcast the content on a second channel at time T2, the central broadcast station further being capable of communicating to the auxiliary tuner at the second user location to capture content from the first channel in the FIFO buffer, such that the second user views a first portion of the requested content corresponding in length from T1 to T2 on a second channel while the auxiliary tuner captures a second portion of the content from the first channel starting at T2 to the end of the program in the FIFO buffer, such that the second user views the second portion of the content from the FIFO buffer after viewing the first portion of the content from the second channel, such that the second channel is freed for use.

8. The system of claim 7, further comprising a locking mechanism to ensure

that the content is downloaded from the first channel to the FIFO buffer of the auxiliary tuner of the second user location.

9. The system of claim 7, wherein:

the central broadcast station is capable of recognizing a third request by a third user for the same streaming content and begins to broadcast the content on a second channel at time T3, the central broadcast station further being capable of communicating to the auxiliary tuner at the third user location to capture content from the first channel in the FIFO buffer, such that the second user views a third portion of the requested content corresponding in length from T1 to T3 on a third channel while the auxiliary tuner captures a fourth portion of the content from the first channel starting at T3 to the end of the program in the FIFO buffer, such that the third user views the fourth portion of the content from the FIFO buffer after viewing the third portion of the content from the third channel, such that the third channel is freed for use.

10. A method for providing streaming content, comprising:

receiving the streaming content at a first user station on a first channel;

receiving a first portion of the streaming content at a second user station on a second channel while a second portion of the streaming content is downloaded to a FIFO buffer;

transmitting the second portion of the streaming content from the FIFO buffer after the first portion of the streaming content is completed; and

freeing the second channel for use after transmitting begins.

11. The method of claim 10, and further comprising

downloading the entire remaining streaming content from the first channel to the FIFO buffer.

12. The method of claim 10, further comprising:

receiving a third portion of the program at a third user station on a third channel while a fourth portion of the program is downloaded to a FIFO buffer;

transmitting the fourth portion of the program from the FIFO buffer after the third portion of the program is completed; and

freeing the third channel for use after transmitting begins.

13. The method of claim 12, and further comprising:

ensuring that the fourth portion of the program is completely downloaded to the FIFO buffer of the third user location if the first user station stops receiving the program before it ends.

14. A method for providing streaming content, the method comprising:

providing a system comprising a central broadcast station and at least two user locations connected to the central broadcast station, each of said at least two user locations comprising receiving equipment capable of tuning into more than one channel simultaneously and an auxiliary tuner having a first in first out (FIFO) buffer capable of capturing content from a first channel as it presents content from a second channel;

sending a first request for streaming content from a first user location to the central broadcast station;

broadcasting requested streaming content from the central broadcast station to the first user location and a first channel at time T1 in response to the first request;

sending a second request for the same streaming content from a second user location to the central broadcast station;

broadcasting the first portion of the content corresponding in length from T1 to T2 by the central broadcast station commencing at time T2 on a second channel to the second user location;

communicating to the auxiliary tuner of the second user location instructions to capture content from the first channel in the FIFO buffer starting at time T2;

capturing by the auxiliary tuner of a second portion of the content from the first channel in the FIFO buffer starting at time T2 until the end of the program; and

viewing by the second user of the first portion of the requested content on a second channel while the auxiliary tuner captures the second portion of the content in the FIFO buffer.

15. The method of claim 14, wherein the system further comprises a locking mechanism to ensure that the content is downloaded from the first channel to the FIFO buffer of the auxiliary tuner of the second user location.

16. The method of claim 14, further comprising:

sending a third request for the same streaming content from a third user location to the central broadcast station;

recognition by the central broadcast station of the third request;

broadcasting by the central broadcast station commencing at time T3 on a third channel to the third user location, the third portion of the content corresponding in length from T1 to T3;

communicating by the central broadcasting station to the auxiliary tuner of the third user location instructions to capture content from the first channel in the FIFO buffer starting at time T3;

capturing by the auxiliary tuner of a fourth portion of the content from the first channel in the FIFO buffer starting at time T3 until the end of the program; and

viewing by the third user of the third portion of the requested content on a third channel while the auxiliary tuner captures the fourth portion of the content in the FIFO buffer.

17. A computer-readable medium having computer-executable instructions for performing a method comprising:

receiving streaming content at a first user station on a first channel;

receiving a first portion of the streaming content at a second user station on a second channel while a second portion of the program is downloaded to a FIFO buffer;

transmitting the second portion of the streaming content from the FIFO

buffer after the first portion of the streaming content is completed; and

freeing the second channel for use after transmitting begins.

18. The method of claim 17, and further comprising:

downloading the entire remaining streaming content from the first channel to the FIFO buffer.

19. The computer-readable medium of claim 19, wherein the method further comprises:

receiving a third portion of the program at a third user station on a third channel while a fourth portion of the program is downloaded to a FIFO buffer;

transmitting the fourth portion of the program from the FIFO buffer after the third portion of the program is completed; and

freeing the third channel for use after transmitting begins.

20. A machine readable medium having machine readable instructions for executing a method comprising:

providing a system comprising a central broadcast station and at least two user locations connected to the central broadcast station, each of said at least two user locations comprising receiving equipment capable of tuning into more than one channel simultaneously and an auxiliary tuner having a first in first out (FIFO) buffer capable of capturing content from a first channel as it presents content from a second channel;

sending a first request for streaming content from a first user location to the central broadcast station;

broadcasting requested streaming content from the central broadcast station to the first user location and a first channel at time T1 in response to the first request;

sending a second request for the same streaming content from a second user location to the central broadcast station;

broadcasting the first portion of the content corresponding in length from time T1 to time T2 by the central broadcast station commencing at time T2 on a

second channel to the second user location;

communicating by the central broadcasting station to the auxiliary tuner of the second user location instructions to capture content from the first channel in the FIFO buffer starting at time T2;

capturing by the auxiliary tuner of a second portion of the content from the first channel in the FIFO buffer starting at time T2 until the end of the program;

viewing by the second user of the first portion of the requested content on a second channel while the auxiliary tuner captures the second portion of the content in the FIFO buffer;

transmitting from the buffer the second portion of the content; and

freeing the second channel for use after transmitting begins.

21. The machine readable medium of claim 20, wherein the method further comprises:

sending a third request for the same streaming content from a third user location to the central broadcast station;

broadcasting by the central broadcast station commencing at time T3 on a third channel to the third user location, the third portion of the content corresponding in length from T1 to T3;

communicating by the central broadcasting station to the auxiliary tuner of the third user location instructions to capture content from the first channel in the FIFO buffer starting at time T3;

capturing by the auxiliary tuner of a fourth portion of the content from the first channel in the FIFO buffer starting at time T3 until the end of the program;

viewing the captured fourth portion of the content from the FIFO buffer; and

freeing the third channel after viewing the captured fourth portion begins.

22. A streaming content receiving station, comprising:

a first tuner capable of receiving time-shifted identical streaming content on two channels; and

a first in first out (FIFO) buffer to capture a portion of the streaming content from one of the two channels while another portion of the streaming content is displayed on the other of the two channels.

23. The system of claim 2, wherein each user location further comprises a second FIFO buffer for capturing content from an additional channel.

24. The system of claim 23, wherein:

each of the said at least two user locations comprises a first user location, a second user location, and a third user location,

the first user location is capable of receiving a program on a first channel, and

the second user location is capable of receiving a receiving a first portion of the program on a second channel while a second portion of the program is downloaded to the FIFO buffer of the second user location wherein the FIFO buffer is capable of transmitting the second portion of the program after the first portion of the program is completed, such that the second channel is freed for use after the transmitting begins, and

the third user location is capable of receiving a first subportion of the first portion of the program on a third channel while a second subportion of the first portion of the program is downloaded to a first FIFO buffer of the third user location and a third portion is downloaded to a second FIFO buffer of the third user location; and

wherein the FIFO buffer is capable of transmitting the second portion of the program after the first portion of the program is completed, such that the second channel is freed for use after the transmitting begins.

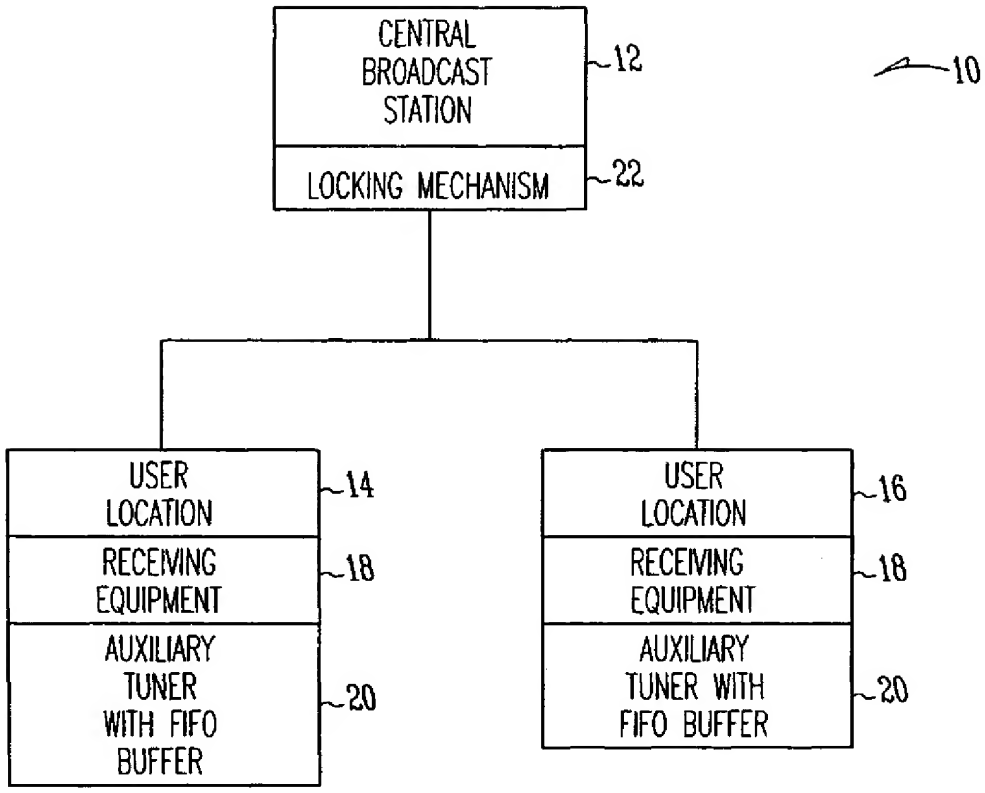


Fig. 1

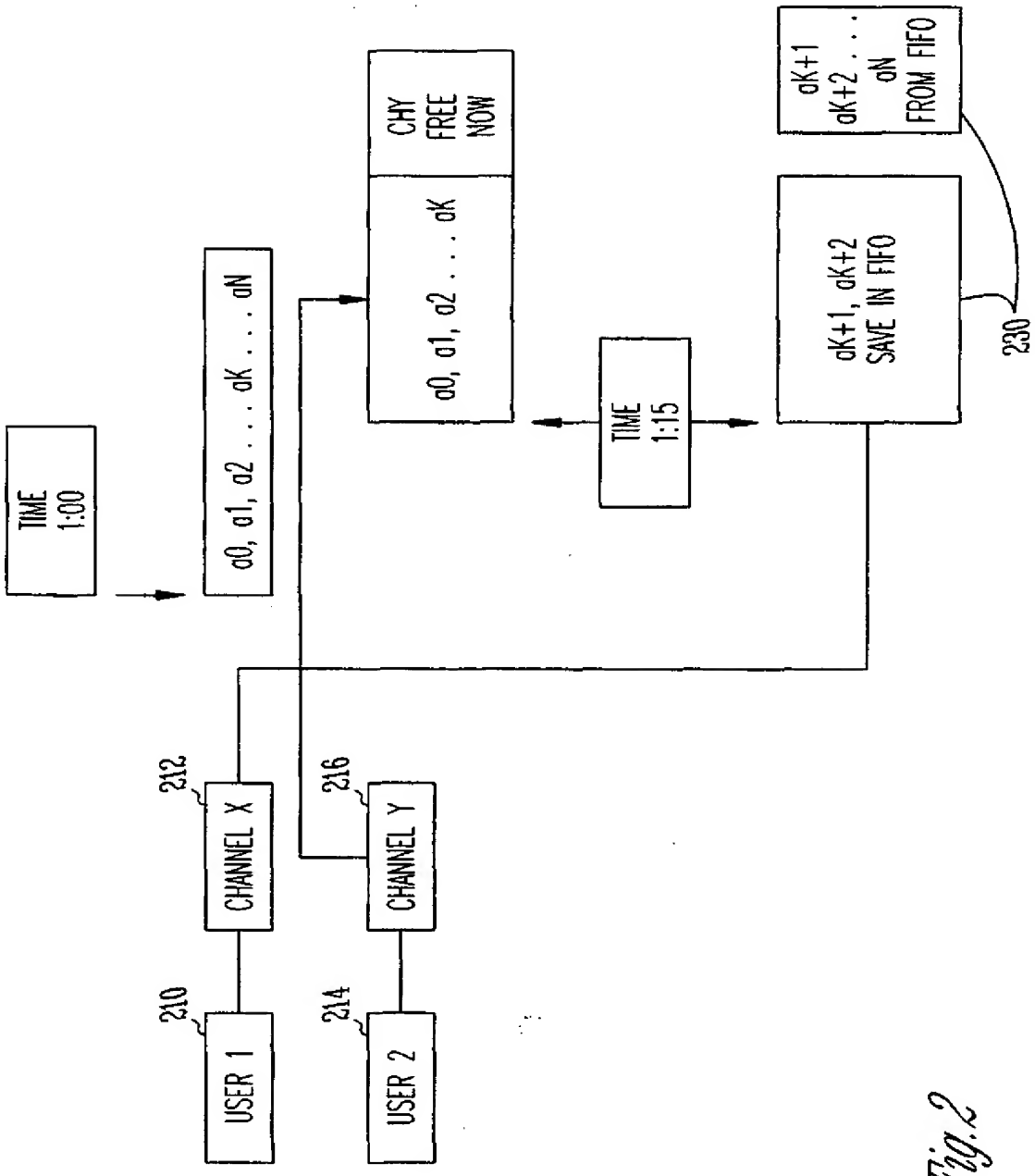


Fig.2

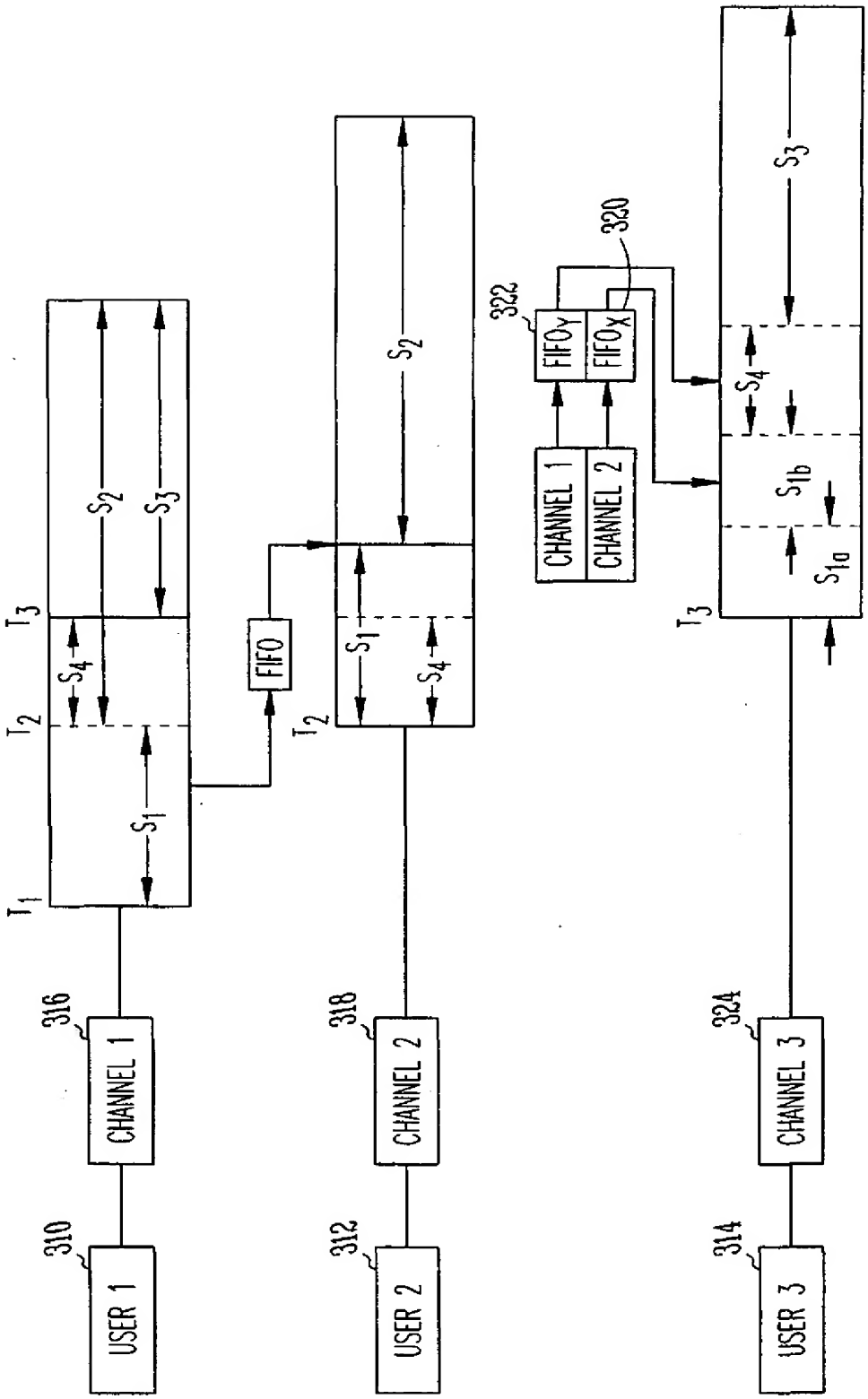


Fig. 3

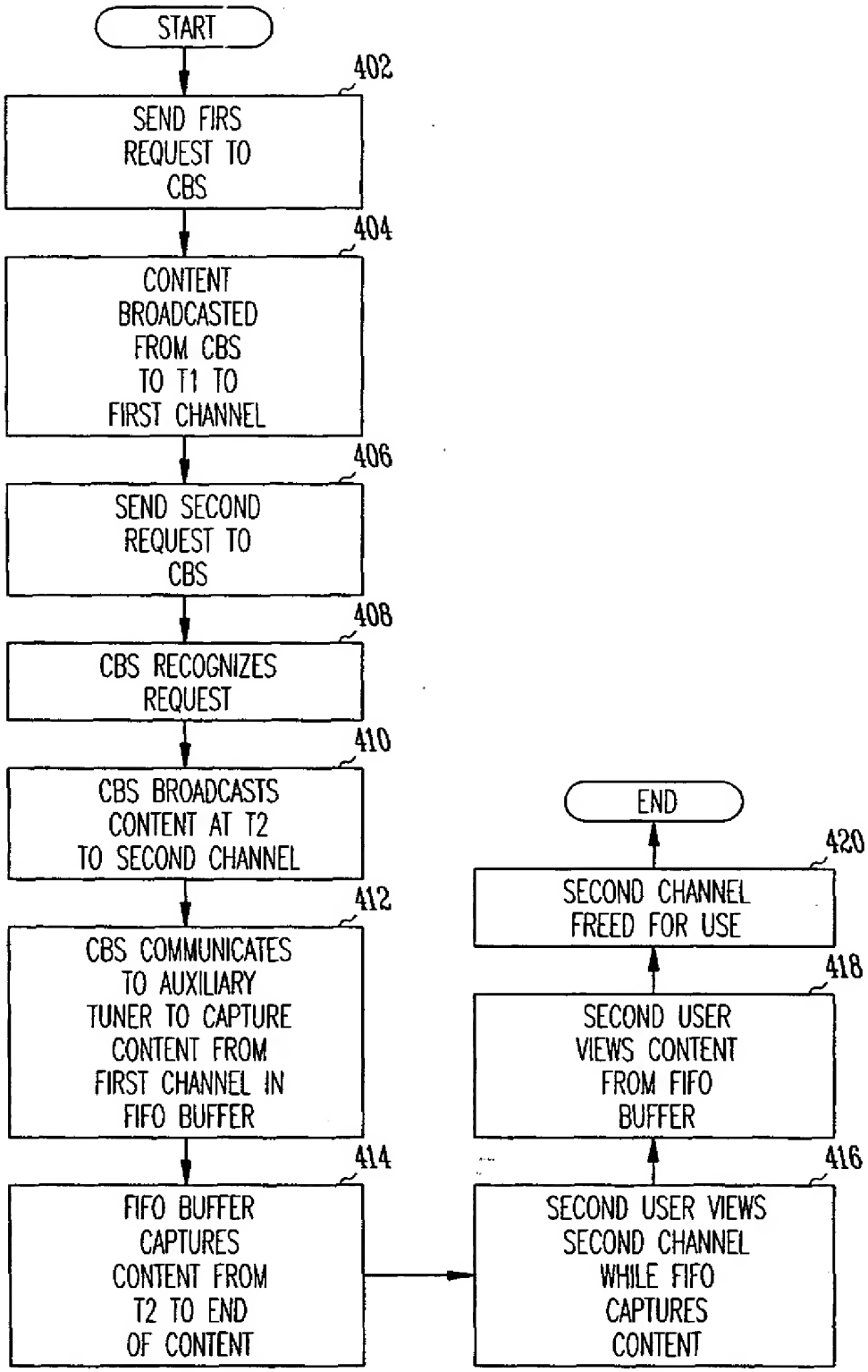


Fig. 4

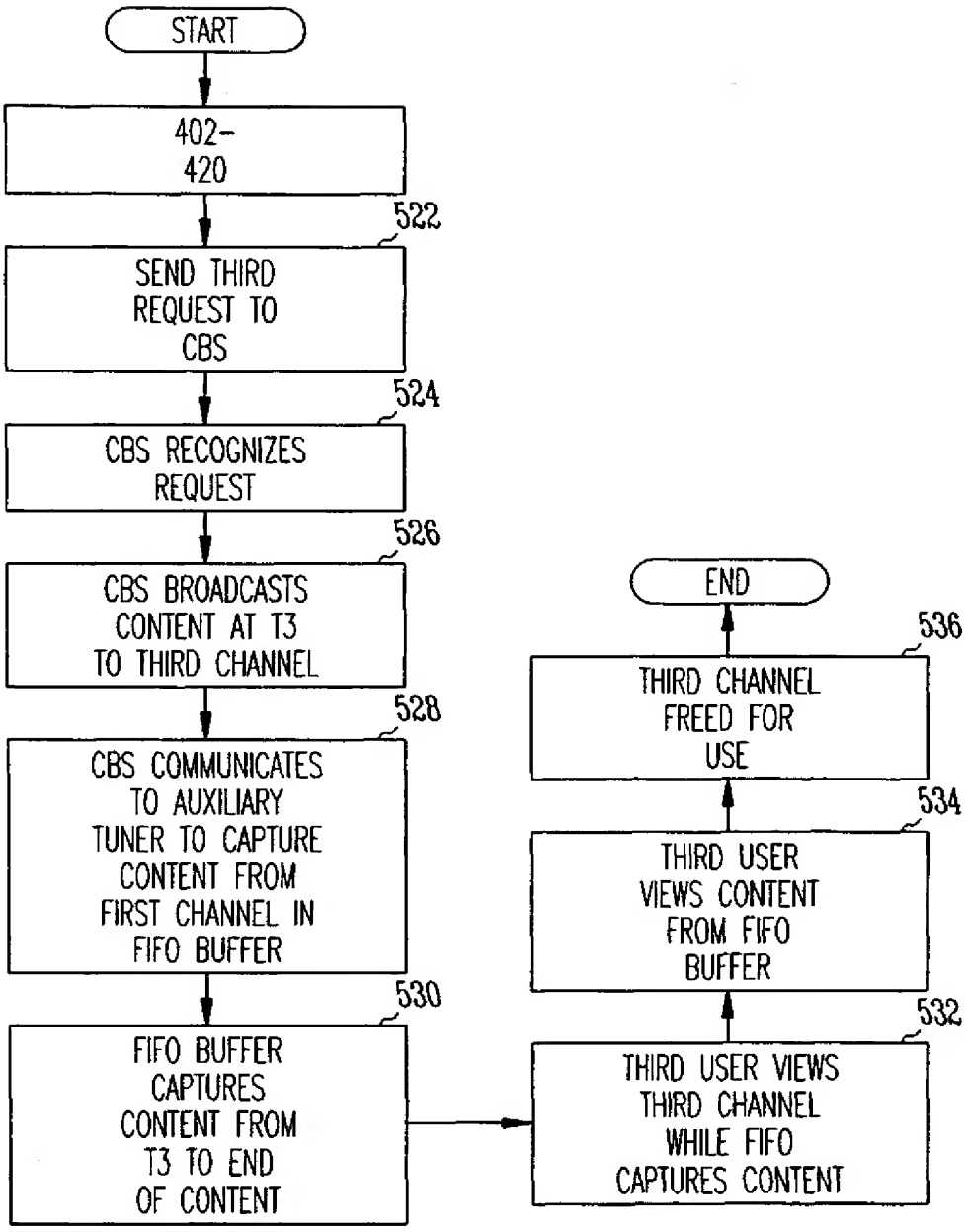


Fig. 5

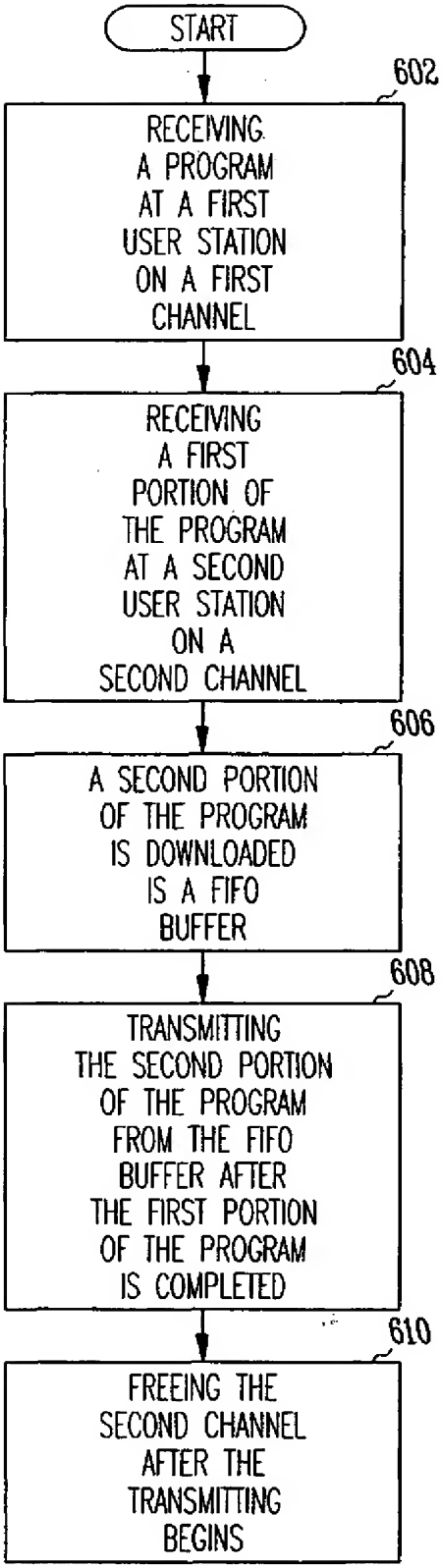


Fig. 6

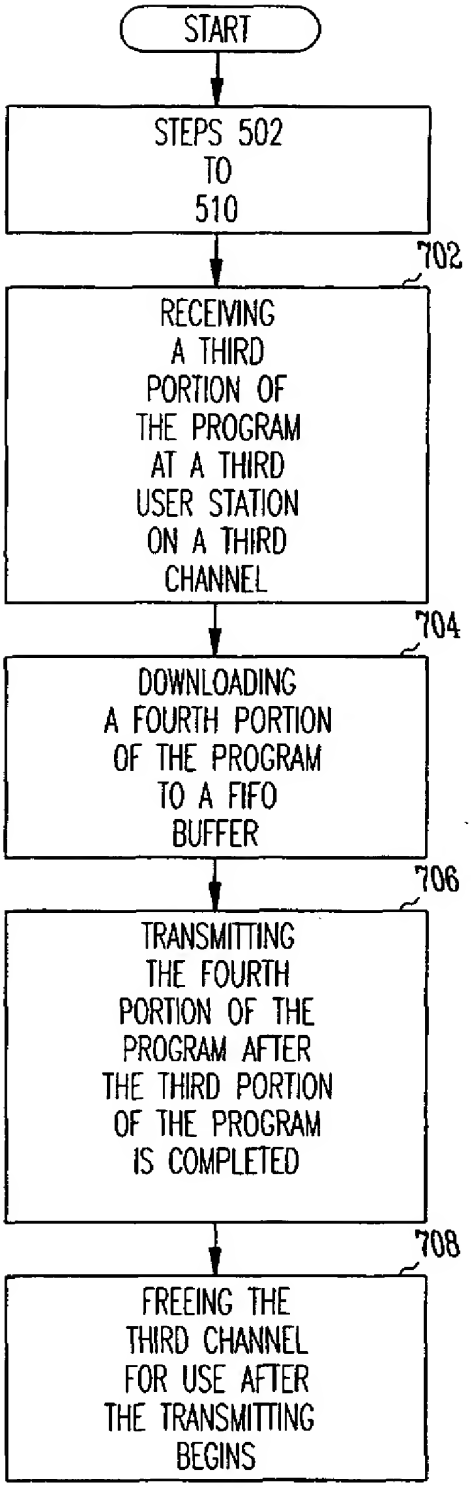


Fig. 7

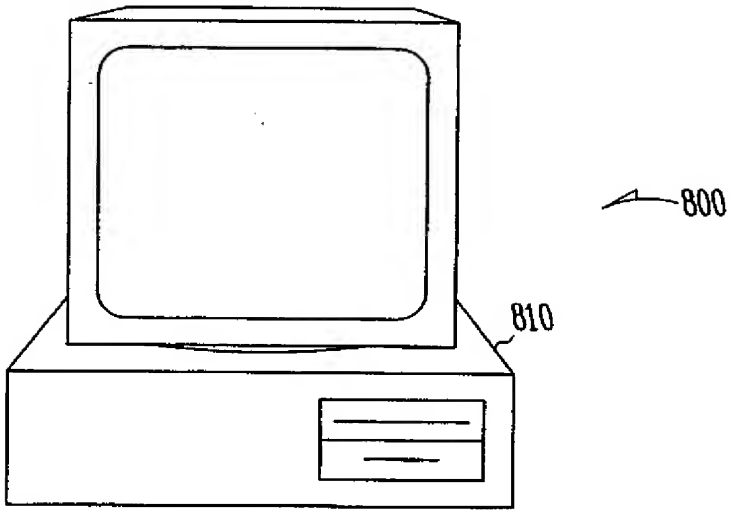


Fig. 8

INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/IB 00/01852

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CARTER S W ET AL: "IMPROVING BANDWIDTH EFFICIENCY OF VIDEO-ON-DEMAND SERVERS" COMPUTER NETWORKS AND ISDN SYSTEMS,NL,NORTH HOLLAND PUBLISHING. AMSTERDAM, vol. 31, no. 1/02, 14 January 1999 (1999-01-14), pages 111-123, XP000700330 ISSN: 0169-7552 paragraph '03.1! paragraph '03.4! figures 2,3 --- -/--	1-24

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 April 2001	04/05/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Fantini, F

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int ational Application No
PCT/IB 00/01852

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HARI KALVA, BORKO FURHT: "Techniques for Improving the Capacity of Video-On-Demand Systems" PROCEEDINGS OF THE 29TH ANNUAL HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES, 1996, pages 308-315, XP002164945 paragraph '0004!	1-3,5,7, 9-12,14, 16-22
A	figure 4	4,6,8, 13,15, 23,24
X	US 5 371 551 A (LOGAN JAMES ET AL) 6 December 1994 (1994-12-06) abstract	1,2,22
A	figure 1	10,14, 17,20
X	EP 0 785 675 A (TOKYO SHIBAURA ELECTRIC CO) 23 July 1997 (1997-07-23)	1,2,22
A	figure 1	10,14, 17,20
A	SIMON SHEU, KIEN A. HUA, WALLAPAK TAVANAPONG: "Chaining: A Generalized Batching Technique for Video-On-Demand Systems" MULTIMEDIA COMPUTING AND SYSTEMS '97. PROCEEDINGS., IEEE INTERNATIONAL, 1997, pages 110-117, XP002164946 page 110 -page 111 figure 1	1,10,14, 17,20,22
A	EP 0 594 350 A (AMERICAN TELEPHONE & TELEGRAPH) 27 April 1994 (1994-04-27) abstract column 9, line 41 -column 11, line 51	1,10,14, 17,20,22

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

In ational Application No
PCT/IB 00/01852

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5371551 A	06-12-1994	US RE36801 E	01-08-2000
EP 0785675 A	23-07-1997	JP 9200691 A	31-07-1997
		CA 2195161 A	17-07-1997
EP 0594350 A	27-04-1994	US 5446490 A	29-08-1995
		CA 2106828 A	24-04-1994
		DE 69322482 D	21-01-1999
		DE 69322482 T	08-07-1999
		JP 3014907 B	28-02-2000
		JP 6224864 A	12-08-1994